

FORM PTO-1390 (Modified)  
(REV 11-99)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

TRANSMITTAL LETTER TO THE UNITED STATES  
DESIGNATED/ELECTED OFFICE (DO/EO/US)  
CONCERNING A FILING UNDER 35 U.S.C. 371

1200.459

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR

09/787952

INTERNATIONAL APPLICATION NO.

PCT/FR00/02245

INTERNATIONAL FILING DATE

4 August 2000

PRIORITY DATE CLAIMED

9 August 1999

TITLE OF INVENTION

SYSTEM, ESPECIALLY FOR A MOTOR VEHICLE, ABLE TO START AN INTERNAL-COMBUSTION ENGINE  
AND CHARGE AN ELECTRICAL CIRCUIT

APPLICANT(S) FOR DO/EO/US

RICHARD, Daniel



Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☐ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
  - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☒ has been transmitted by the International Bureau.
  - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ A copy of the International Search Report (PCT/ISA/210).
8. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
  - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☐ have been transmitted by the International Bureau.
  - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
  - d. ☐ have not been made and will not be made.
9. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
10. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
11. ☐ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

## Items 13 to 20 below concern document(s) or information included:

13. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☐ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☐ Certificate of Mailing by Express Mail
20. ☐ Other items or information:

Form PCT/RO125; 3 Cited Ref

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR

09/787952

INTERNATIONAL APPLICATION NO.

PCT/FR00/02245

ATTORNEY'S DOCKET NUMBER

1200.459

21. The following fees are submitted:

**BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :**

- ☐ Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO ..... \$970.00
- ☒ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO ..... \$840.00
- ☐ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... \$690.00
- ☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) ..... \$670.00
- ☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) ..... \$96.00

**CALCULATIONS PTO USE ONLY****ENTER APPROPRIATE BASIC FEE AMOUNT =****\$840.00**

Surcharge of **\$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).

**\$0.00**

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	
Total claims	16 - 20 =	0	x \$18.00	<b>\$0.00</b>
Independent claims	2 - 3 =	0	x \$78.00	<b>\$0.00</b>
Multiple Dependent Claims (check if applicable).			<input type="checkbox"/>	<b>\$0.00</b>

**TOTAL OF ABOVE CALCULATIONS = \$840.00**

Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) (check if applicable). ☐

**\$0.00****SUBTOTAL = \$840.00**

Processing fee of **\$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (f)).

**\$0.00****TOTAL NATIONAL FEE = \$840.00**

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable). ☒

**\$40.00****TOTAL FEES ENCLOSED = \$880.00**

Amount to be:  
refunded \$  
charged \$

☒ A check in the amount of **\$880.00** to cover the above fees is enclosed.

☐ Please charge my Deposit Account No. \_\_\_\_\_ in the amount of \_\_\_\_\_ to cover the above fees.  
A duplicate copy of this sheet is enclosed.

☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **50-0548** A duplicate copy of this sheet is enclosed.

**NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.**

SEND ALL CORRESPONDENCE TO:

Liniak, Berenato, Longacre & White  
6550 Rock Spring Drive  
Suite 240  
Bethesda, MD 20817  
(301)896-0600

SIGNATURE

Matthew W. Stavish

NAME

36,286

REGISTRATION NUMBER

March 23, 2001

DATE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: RICHARD, D.

Appl. No: unknown

Group Art Unit: unknown

Filed: March 23, 2001

Examiner: unknown

Title: SYSTEM, ESPECIALLY FOR A MOTOR VEHICLE, ABLE TO START AN  
INTERNAL-COMBUSTION ENGINE AND CHARGE AN ELECTRICAL CIRCUIT

**PRELIMINARY AMENDMENT**

Hon. Commissioner of Patents  
and Trademark  
Washington, DC 20231

March 23, 2001

Sir: Please enter the following amendments prior to examination on the merits.

## IN THE CLAIMS

Please amend claims 3,4,8, and 9 as follows.

3. System according to Claim 1, characterised in that the detection means include means for detecting a failure to start at the end of a given time during which the main electrical machine is operating in motor mode.

4. System according to Claim 1, characterised in that the management means include means for actuating the supplementary starter, when a condition for activating the supplementary starter is detected, in such a way that its pinion meshes on a complementary ring in order to drive the internal-combustion engine, in order to drive the main electrical machine in motor mode, when the pinion of the starter has been meshed and in order to cut off the starter and drive the main electrical machine in generator mode when it is detected that the internal-combustion engine has started.

8. Method according to Claim 6, characterised in that, in order to detect a triggering condition, a failure to start is detected at the end of a given time during which the main electrical machine is operating in motor mode.

9. Method according to Claim 6, characterised in that, when a condition for activating the supplementary starter is detected, the supplementary starter is actuated in such a way that its pinion meshes on a complementary ring in order to drive the internal-combustion engine, the main electrical

machine is put into motor mode, when the pinion of the starter has been meshed, and the starter is cut off and the main electrical machine is placed into generator mode when it is detected that the internal-combustion engine has started.

09787952.032301

Please add new claims 11-16 as follows.

11. System according to Claim 2, characterised in that the detection means include means for detecting a failure to start at the end of a given time during which the main electrical machine is operating in motor mode.

12. System according to Claim 2, characterised in that the management means include means for actuating the supplementary starter, when a condition for activating the supplementary starter is detected, in such a way that its pinion meshes on a complementary ring in order to drive the internal-combustion engine, in order to drive the main electrical machine in motor mode, when the pinion of the starter has been meshed and in order to cut off the starter and drive the main electrical machine in generator mode when it is detected that the internal-combustion engine has started.

13. System according to Claim 3, characterised in that the management means include means for actuating the supplementary starter, when a condition for activating the supplementary starter is detected, in such a way that its pinion meshes on a complementary ring in order to drive the internal-combustion engine, in order to drive the main electrical machine in motor mode, when the pinion of the starter has been meshed and in order to cut off the starter and drive the main electrical machine in generator mode when it is detected that the internal-combustion engine has started.

14. Method according to Claim 7, characterised in that, in order to detect a triggering condition, a failure to start is detected at the end of a given time during which the main electrical machine is operating in motor mode.

15. Method according to Claim 7, characterised in that, when a condition for activating the supplementary starter is detected, the supplementary starter is actuated in such a way that its pinion meshes on a complementary ring in order to drive the internal-combustion engine, the main electrical

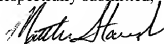
machine is put into motor mode, when the pinion of the starter has been meshed, and the starter is cut off and the main electrical machine is placed into generator mode when it is detected that the internal-combustion engine has started.

16. Method according to Claim 8, characterised in that, when a condition for activating the supplementary starter is detected, the supplementary starter is actuated in such a way that its pinion meshes on a complementary ring in order to drive the internal-combustion engine, the main electrical machine is put into motor mode, when the pinion of the starter has been meshed, and the starter is cut off and the main electrical machine is placed into generator mode when it is detected that the internal-combustion engine has started.

REMARKS

This preliminary amendment is intended to place the instant application in better condition for examination on the merits. Should the examiner believe further discussion would advance prosecution, they are invited to contact the undersigned.

Respectfully submitted,



Matthew W. Stavish

Reg No. 36,286

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65  
66  
67  
68  
69  
70  
71  
72  
73  
74  
75  
76  
77  
78  
79  
80  
81  
82  
83  
84  
85  
86  
87  
88  
89  
90  
91  
92  
93  
94  
95  
96  
97  
98  
99  
100  
101  
102  
103  
104  
105  
106  
107  
108  
109  
110  
111  
112  
113  
114  
115  
116  
117  
118  
119  
120  
121  
122  
123  
124  
125  
126  
127  
128  
129  
130  
131  
132  
133  
134  
135  
136  
137  
138  
139  
140  
141  
142  
143  
144  
145  
146  
147  
148  
149  
150  
151  
152  
153  
154  
155  
156  
157  
158  
159  
160  
161  
162  
163  
164  
165  
166  
167  
168  
169  
170  
171  
172  
173  
174  
175  
176  
177  
178  
179  
180  
181  
182  
183  
184  
185  
186  
187  
188  
189  
190  
191  
192  
193  
194  
195  
196  
197  
198  
199  
200  
201  
202  
203  
204  
205  
206  
207  
208  
209  
210  
211  
212  
213  
214  
215  
216  
217  
218  
219  
220  
221  
222  
223  
224  
225  
226  
227  
228  
229  
230  
231  
232  
233  
234  
235  
236  
237  
238  
239  
240  
241  
242  
243  
244  
245  
246  
247  
248  
249  
250  
251  
252  
253  
254  
255  
256  
257  
258  
259  
260  
261  
262  
263  
264  
265  
266  
267  
268  
269  
270  
271  
272  
273  
274  
275  
276  
277  
278  
279  
280  
281  
282  
283  
284  
285  
286  
287  
288  
289  
290  
291  
292  
293  
294  
295  
296  
297  
298  
299  
300  
301  
302  
303  
304  
305  
306  
307  
308  
309  
310  
311  
312  
313  
314  
315  
316  
317  
318  
319  
320  
321  
322  
323  
324  
325  
326  
327  
328  
329  
330  
331  
332  
333  
334  
335  
336  
337  
338  
339  
340  
341  
342  
343  
344  
345  
346  
347  
348  
349  
350  
351  
352  
353  
354  
355  
356  
357  
358  
359  
360  
361  
362  
363  
364  
365  
366  
367  
368  
369  
370  
371  
372  
373  
374  
375  
376  
377  
378  
379  
380  
381  
382  
383  
384  
385  
386  
387  
388  
389  
390  
391  
392  
393  
394  
395  
396  
397  
398  
399  
400  
401  
402  
403  
404  
405  
406  
407  
408  
409  
410  
411  
412  
413  
414  
415  
416  
417  
418  
419  
420  
421  
422  
423  
424  
425  
426  
427  
428  
429  
430  
431  
432  
433  
434  
435  
436  
437  
438  
439  
440  
441  
442  
443  
444  
445  
446  
447  
448  
449  
450  
451  
452  
453  
454  
455  
456  
457  
458  
459  
460  
461  
462  
463  
464  
465  
466  
467  
468  
469  
470  
471  
472  
473  
474  
475  
476  
477  
478  
479  
480  
481  
482  
483  
484  
485  
486  
487  
488  
489  
490  
491  
492  
493  
494  
495  
496  
497  
498  
499  
500  
501  
502  
503  
504  
505  
506  
507  
508  
509  
510  
511  
512  
513  
514  
515  
516  
517  
518  
519  
520  
521  
522  
523  
524  
525  
526  
527  
528  
529  
530  
531  
532  
533  
534  
535  
536  
537  
538  
539  
540  
541  
542  
543  
544  
545  
546  
547  
548  
549  
550  
551  
552  
553  
554  
555  
556  
557  
558  
559  
560  
561  
562  
563  
564  
565  
566  
567  
568  
569  
570  
571  
572  
573  
574  
575  
576  
577  
578  
579  
580  
581  
582  
583  
584  
585  
586  
587  
588  
589  
590  
591  
592  
593  
594  
595  
596  
597  
598  
599  
600  
601  
602  
603  
604  
605  
606  
607  
608  
609  
610  
611  
612  
613  
614  
615  
616  
617  
618  
619  
620  
621  
622  
623  
624  
625  
626  
627  
628  
629  
630  
631  
632  
633  
634  
635  
636  
637  
638  
639  
640  
641  
642  
643  
644  
645  
646  
647  
648  
649  
650  
651  
652  
653  
654  
655  
656  
657  
658  
659  
660  
661  
662  
663  
664  
665  
666  
667  
668  
669  
670  
671  
672  
673  
674  
675  
676  
677  
678  
679  
680  
681  
682  
683  
684  
685  
686  
687  
688  
689  
690  
691  
692  
693  
694  
695  
696  
697  
698  
699  
700  
701  
702  
703  
704  
705  
706  
707  
708  
709  
710  
711  
712  
713  
714  
715  
716  
717  
718  
719  
720  
721  
722  
723  
724  
725  
726  
727  
728  
729  
730  
731  
732  
733  
734  
735  
736  
737  
738  
739  
740  
741  
742  
743  
744  
745  
746  
747  
748  
749  
750  
751  
752  
753  
754  
755  
756  
757  
758  
759  
760  
761  
762  
763  
764  
765  
766  
767  
768  
769  
770  
771  
772  
773  
774  
775  
776  
777  
778  
779  
780  
781  
782  
783  
784  
785  
786  
787  
788  
789  
790  
791  
792  
793  
794  
795  
796  
797  
798  
799  
800  
801  
802  
803  
804  
805  
806  
807  
808  
809  
810  
811  
812  
813  
814  
815  
816  
817  
818  
819  
820  
821  
822  
823  
824  
825  
826  
827  
828  
829  
830  
831  
832  
833  
834  
835  
836  
837  
838  
839  
840  
841  
842  
843  
844  
845  
846  
847  
848  
849  
850  
851  
852  
853  
854  
855  
856  
857  
858  
859  
860  
861  
862  
863  
864  
865  
866  
867  
868  
869  
870  
871  
872  
873  
874  
875  
876  
877  
878  
879  
880  
881  
882  
883  
884  
885  
886  
887  
888  
889  
890  
891  
892  
893  
894  
895  
896  
897  
898  
899  
900  
901  
902  
903  
904  
905  
906  
907  
908  
909  
910  
911  
912  
913  
914  
915  
916  
917  
918  
919  
920  
921  
922  
923  
924  
925  
926  
927  
928  
929  
930  
931  
932  
933  
934  
935  
936  
937  
938  
939  
940  
941  
942  
943  
944  
945  
946  
947  
948  
949  
950  
951  
952  
953  
954  
955  
956  
957  
958  
959  
960  
961  
962  
963  
964  
965  
966  
967  
968  
969  
970  
971  
972  
973  
974  
975  
976  
977  
978  
979  
980  
981  
982  
983  
984  
985  
986  
987  
988  
989  
990  
991  
992  
993  
994  
995  
996  
997  
998  
999  
1000

LINIAK, BERENATO, LONGACRE & WHITE  
6550 Rock Spring Drive  
Suite 240  
Bethesda, MD 20817  
Tel. (301)896-0600



## APPENDIX

3. System according to [one of Claims 1 and 2] Claim 1, characterised in that the detection means include means for detecting a failure to start at the end of a given time during which the main electrical machine is operating in motor mode.

4. System according to [one of the preceding claims] Claim 1, characterised in that the management means include means for actuating the supplementary starter, when a condition for activating the supplementary starter is detected, in such a way that its pinion meshes on a complementary ring in order to drive the internal-combustion engine, in order to drive the main electrical machine in motor mode, when the pinion of the starter has been meshed and in order to cut off the starter and drive the main electrical machine in generator mode when it is detected that the internal-combustion engine has started.

8. Method according to [one of Claims 6 and 7] Claim 6, characterised in that, in order to detect a triggering condition, a failure to start is detected at the end of a given time during which the main electrical machine is operating in motor mode.

9. Method according to [one of Claims 6 to 8] Claim 6, characterised in that, when a condition for activating the supplementary starter is detected, the supplementary starter is actuated in such a way that its pinion meshes on a complementary ring in order to drive the internal-combustion engine, the main electrical machine is put into motor mode, when the pinion of the starter has been meshed, and the starter is cut off and the main electrical machine is placed into generator mode when it is detected that the internal-combustion engine has started.

2/pars

JC03 Rec'd PCT/PTO 09/787952  
23 MAR 2001

**SYSTEM, ESPECIALLY FOR A MOTOR VEHICLE, ABLE TO START  
AN INTERNAL-COMBUSTION ENGINE AND CHARGE AN ELECTRICAL  
CIRCUIT**

5           The present invention relates to the systems,  
especially for motor vehicles, which, on the one hand,  
start up an internal-combustion engine and, on the  
other hand, charge an electrical circuit.

It also relates to the control of such a system.

10           On motor vehicles, the internal-combustion en-  
gine is usually started by a starter, while the charg-  
ing of the battery and the power supply to the consumer  
units is undertaken by an alternator.

15           It has already been proposed to carry out these  
two functions by means of an alternator used both as  
generator and as electric motor. Such an electrical ma-  
chine which carries out the two functions at the same  
time is currently designated by the name of alterna-  
tor/starter.

20           For a presentation of such a machine, reference  
may advantageously be made to the patent FR 2 745 444.

25           This machine is generally arranged in place of  
the alternator. In motor mode, it drives the pulley of  
the crankshaft by means of the belt which is also used  
in generator mode. It is then spoken of as an alterna-  
tor/starter of separate type, as opposed to alterna-  
tor/starter machines which would drive the internal-  
combustion engine directly by means of a pinion meshing  
with a ring gear.

30           The alternator/starters of separate type exhibit  
certain drawbacks, when operating in motor mode.

Especially under certain extreme conditions,  
particularly at low temperature, the internal-  
combustion engine offers a substantial resisting torque  
35 which can prevent satisfactory driving via the belt.

Likewise, separate alternator/starters do not allow for rapid starting in all cases. The starting time can be relatively lengthy, especially if the internal-combustion engine is experiencing injection problems, or else because of the fact that the belt is slipping, etc.

However, it is desirable for the starting-up of a vehicle to be able to be carried out in relatively short times, in particular when the on-board computer of the vehicle implements a mode of operation, for the internal-combustion engine, with automatic cut-off and restarting of the internal-combustion engine when the vehicle is stopped (operation of "stop & go" type, according to the terminology usually used by the person skilled in the art).

The invention, for its part, proposes a starting and charging system and a drive which makes it possible to remedy these drawbacks.

More particularly, the invention relates to a system, especially for a motor vehicle, able, on the one hand, to start up an internal-combustion engine and, on the other hand, to charge an electrical circuit, including a main electrical machine able to operate, on the one hand, as a generator and, on the other hand, as an electric motor, the said electrical machine driving the internal-combustion engine by means of a belt when it is operating in motor mode, the system further including management means which drive the main electrical machine.

The said system is such that it includes a supplementary starter, as well as means for detecting at least one condition for triggering the activation of the said supplementary starter, and the management means drive the main electrical machine and the starter, according to a particular sequence, when the said condition is detected by the said detection means.

Thus the system includes supplementary starting means (the starter) which, when a condition requiring them to be activated is detected, supplements the main electrical machine, according to a synchronised operation, with that of the said machine.

Moreover, such a system is advantageously supplemented by the various characteristics below, taken alone or in all their technically possible combinations:

- the said detection means include at least one temperature sensor, as well as means for comparing a temperature measured by the said sensor with a particular low threshold.

- the detection means include means for detecting a failure to start at the end of a given time during which the main electrical machine is operating in motor mode.

- the management means include means for actuating the supplementary starter, when a condition for activating the supplementary starter is detected, in such a way that its pinion meshes on a complementary ring in order to drive the internal-combustion engine, in order to drive the main electrical machine in motor mode, when the pinion of the starter has been meshed and in order to cut off the starter and drive the main electrical machine in generator mode when it is detected that the internal-combustion engine has started.

- the management means include means for cutting off the operation of the main electrical machine in motor mode, when a condition for activation of the supplementary starter is detected.

The invention also relates to a method for control of a system, especially for a motor vehicle, able, on the one hand, to start up an internal-combustion engine and, on the other hand, to charge an electrical circuit, including a main electrical machine able to

operate, on the one hand, as a generator and, on the other hand, as an electric motor, the said electrical machine driving the internal-combustion engine by means of a belt when it is operating in motor mode, according to which, with the said system including a supplementary starter, at least one condition for triggering the activation of the said supplementary starter is detected, and the main electrical machine and the starter are driven according to a particular sequence when the said condition is detected.

Such a method is advantageously supplemented by the various technical characteristics below, taken alone or according to all their technically possible combinations:

- in order to detect a triggering condition, at least one temperature is measured and a temperature thus measured is compared with a particular low threshold.

- in order to detect a triggering condition, a failure to start is detected at the end of a given time during which the main electrical machine is operating in motor mode.

- when a condition for activating the supplementary starter is detected, the supplementary starter is actuated in such a way that its pinion meshes on a complementary ring in order to drive the internal-combustion engine, the main electrical machine is put into motor mode, when the pinion of the starter has been meshed, and the starter is cut off and the main electrical machine is placed into generator mode when it is detected that the internal-combustion engine has started.

- the operation of the main electrical machine in motor mode is cut off when a condition for activation of the supplementary starter is detected.

Other characteristics and advantages of the invention will emerge further from the description which follows, which is purely illustrative and non-limiting, and which should be read with regard to the attached drawings, in which:

- Figure 1 is a diagram illustrating a system according to one possible embodiment of the invention;

- Figures 2a and 2b are timing graphs on which have been plotted examples of possible power-supply sequences for the alternator/starter and the supplementary starter of the system of Figure 1. The starting and charging system shown in Figure 1 consists of:

- a separate alternator/starter 1, the shaft of which terminates in a pulley 2 which is linked to a pulley 3 of the crankshaft by way of a multi-groove belt 4; this alternator/starter is mounted in the space which the alternator usually takes up;

- a supplementary starter 5, the pinion of which can mesh with the toothing of a crown ring 6 in order to drive the shaft of the internal-combustion engine;

- drive electronics 7.

The drive electronics 7 consist of:

- a transistor bridge 8 which constitutes a reversible power converter, and which provides drive in starter mode and synchronous rectification in alternator mode.

- a management module 9 which drives the various transistors of the converter 8 and manages the following different functions:

- power in starter and alternator modes
- regulation in alternator mode
- transition from the starter mode to the alternator mode
- operating strategy for extreme conditions
- synchronisation of the two machines.

To that end, the said management module 9 is supplied with the voltage from the battery, referenced by B, to which it has been linked by way of a contact breaker 10 of the vehicle.

5       It receives information as input, allowing it to determine the angular position of the rotor of the alternator/starter 1, for example information supplied by sensors 11, such as Hall-effect sensors 11.

10       As output, it supplies the inductor of the alternator/starter 1 as well as the starter 5, and generates the voltages injected onto the gates (A, B, C; A', B', C') of the transistors of the bridge 8.

15       Figures 2a and 2b illustrate three sequences of power supply for the alternator/starter 1 and for the starter 5, corresponding to three different operating cases. These three power-supply sequences have been referenced by I, II and III.

20       The sequence I corresponds to the power supply which is applied when it is detected that the internal-combustion engine and the starting system are in extreme operating conditions.

25       The detection of the extreme conditions is done by means, for example, of one or more temperature sensors (not represented in Figure 1) which are linked to the management module 9, the latter performing a comparison of the measured temperature or temperatures with one or more given thresholds. The threshold or thresholds are, for example, functions of the characteristics of the internal-combustion engine.

30       When these extreme operating conditions are detected, the management module 9 then drives the alternator/starter 1 and the starter 5 according to the following sequence.

35       In a first phase (phase [1] in Figure 2), the starter 5 is supplied with power. Its drive pinion

moves and meshes on the toothed ring 6 of the transmission of the internal-combustion engine.

In a second phase, once engagement is assured, the alternator/starter is driven in motor mode (phase [2]).

When the starting of the internal-combustion engine has been detected, the drive pinion of the starter 5 is made to disengage, while the alternator/starter 1 is switched over into generator mode (phase [3]).

Outside extreme operating conditions, it may happen that the starting invoked by the alternator/starter 1 does not happen sufficiently quickly.

In order to remedy this failure, the management module 9 controls the power supply to the alternator/starter and the starter 5 in the following way (sequence II).

When the closure of the switch 10 calls for starting, the module 9 supplies power to the inductor of the alternator/starter 1 so that it operates in motor mode, while the starter 5 is not called on (phase [1]).

If the internal-combustion engine has still not started at the end of a time T, the power supply to the alternator/starter 1 is shut off, then the supplementary starter 5 is started up, so that its meshing pinion advances, then meshes with the toothed ring 6 (power-supply phase [2]).

After meshing occurs, the alternator/starter 1 is again powered in motor mode (power-supply phase [3]).

When the starting of the internal-combustion engine has been detected, the drive pinion of the starter 5 is disengaged, while the alternator/starter 1 is driven as a generator (phase [4]).

Under normal operating conditions, that is to say if no particular set-point value has been detected



(low temperature, start-up duration exceeded, etc.), the power supply to the alternator/starter 1 and to the starter 5 is managed according to sequence III.

The alternator/starter 1 is initially driven in  
5 motor mode (phase [1]); when the starting of the internal-combustion engine has been detected, generator mode (phase [2]) is entered. For its part, the starter 5 is not activated.

CLAIMS

1. System, especially for a motor vehicle, able, on the one hand, to start up an internal-combustion engine and, on the other hand, to charge an electrical circuit, including a main electrical machine able to operate, on the one hand, as a generator and, on the other hand, as an electric motor, the said electrical machine driving the internal-combustion engine by means of a belt when it is operating in motor mode, the system further including management means which drive the main electrical machine, characterised in that it includes a supplementary starter, as well as means for detecting at least one condition for triggering the activation of the said supplementary starter, and the management means drive the main electrical machine and the starter, according to a particular sequence, when the said condition is detected by the said detection means.
2. System according to Claim 1, characterised in that the said detection means include at least one temperature sensor, as well as means for comparing a temperature measured by the said sensor with a particular low threshold.
3. System according to one of Claims 1 and 2, characterised in that the detection means include means for detecting a failure to start at the end of a given time during which the main electrical machine is operating in motor mode.
4. System according to one of the preceding claims, characterised in that the management means include means for actuating the supplementary starter, when a condition for activating the supplementary starter is detected, in such a way that its pinion meshes on a complementary ring in order to drive the internal-combustion engine, in order to drive the main electrical machine in motor mode, when the pinion of the

starter has been meshed and in order to cut off the starter and drive the main electrical machine in generator mode when it is detected that the internal-combustion engine has started.

5     5.       System according to Claim 4, characterised in that the management means include means for cutting off the operation of the main electrical machine in motor mode, when a condition for activation of the supplementary starter is detected.

10    6.       Method for control of a system, especially for a motor vehicle, able, on the one hand, to start up an internal-combustion engine and, on the other hand, to charge an electrical circuit, including a main electrical machine able to operate, on the one hand, as a generator and, on the other hand, as an electric motor, the said electrical machine driving the internal-combustion engine by means of a belt when it is operating in motor mode, characterised in that, with the said system including a supplementary starter, at least one  
15    condition for triggering the activation of the said supplementary starter is detected, and the main electrical machine and the starter are driven according to a particular sequence when the said condition is detected.  
20

25    7.       Method according to Claim 6, characterised in that, in order to detect a triggering condition, at least one temperature is measured and a temperature thus measured is compared with a particular low threshold.

30    8.       Method according to one of Claims 6 and 7, characterised in that, in order to detect a triggering condition, a failure to start is detected at the end of a given time during which the main electrical machine is operating in motor mode.

35    9.       Method according to one of Claims 6 to 8, characterised in that, when a condition for activating the

supplementary starter is detected, the supplementary starter is actuated in such a way that its pinion meshes on a complementary ring in order to drive the internal-combustion engine, the main electrical machine is put into motor mode, when the pinion of the starter has been meshed, and the starter is cut off and the main electrical machine is placed into generator mode when it is detected that the internal-combustion engine has started.

10 10. Method according to Claim 9, characterised in that the operation of the main electrical machine in motor mode is cut off when a condition for activation of the supplementary starter is detected.

PATENT OF INVENTION

**SYSTEM, ESPECIALLY FOR A MOTOR VEHICLE, ABLE TO START  
AN INTERNAL-COMBUSTION ENGINE AND CHARGE AN ELECTRICAL  
CIRCUIT**

Applicant: VALEO EQUIPEMENTS ELECTRIQUES MOTEUR

---

**ABSTRACT**

System, especially for a motor vehicle, able, on the one hand, to start up an internal-combustion engine and, on the other hand, to charge an electrical circuit, including a main electrical machine able to operate, on the one hand, as a generator and, on the other hand, as an electric motor, the said electrical machine driving the internal-combustion engine by means of a belt when it is operating in motor mode, the system further including management means which drive the main electrical machine, characterised in that it includes a supplementary starter, as well as means for detecting at least one condition for triggering the activation of the said supplementary starter, and the management means drive the main electrical machine and the starter, according to a particular sequence, when the said condition is detected by the said detection means.

FIGURE 1

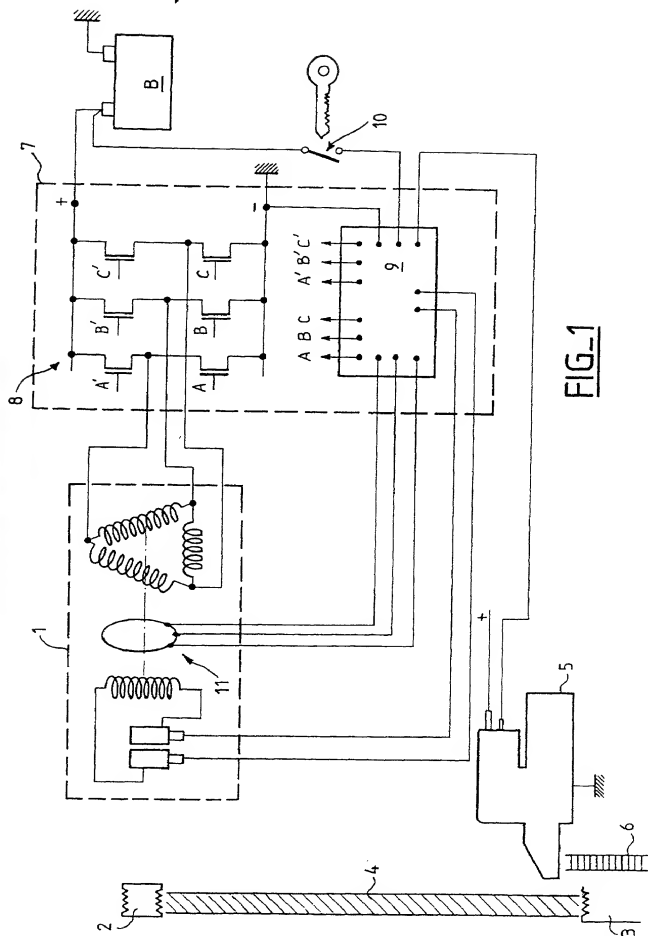
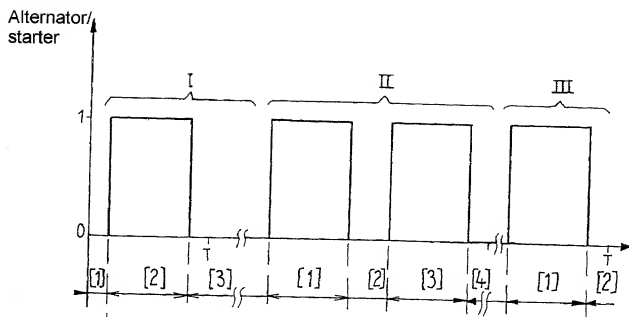
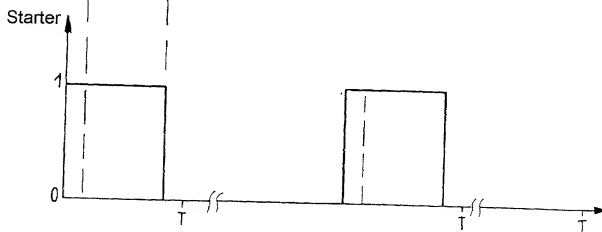


FIG. 1

FIG\_2aFIG\_2b

RULE 63 (37 C.F.R. 1.63)  
DECLARATION AND POWER OF ATTORNEY  
FOR PATENT APPLICATION  
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name, and I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

**SYSTEM, ESPECIALLY FOR A MOTOR VEHICLE, ABLE TO START AN INTERNAL-**  
the specification of which (CHECK applicable BOX(ES)) **COMBUSTION ENGINE AND CHARGE AN ELECTRICAL**  
☐ is claimed hereto. **CIRCUIT**

was filed on \_\_\_\_\_ as U.S. Application Serial Number \_\_\_\_\_  
☒ was filed as PCT international Application Number **PCT/FR00/02245** on **04 August 2000**  
and (if applicable to U.S. or PCT Application) was amended on \_\_\_\_\_

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above, to the best of my ability. I acknowledge the duty to disclose information which is material to the examination of this application in accordance with 37 C.F.R. 1.56 as set forth on the reverse side hereof. I hereby claim foreign priority benefits under 35 U.S.C. 119/365 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date (1) before that of the application on which priority is claimed or (2) if no priority claimed, before the filing date of this application :

PRIOR FOREIGN APPLICATION(S)

Number	Country	Day/Month/Year Filed	Priority Claimed Yes - No
<b>99.10316</b>	<b>FRANCE</b>	<b>09.08.1999</b>	<b>XX</b>

I hereby claim the benefit under 35 U.S.C. 120/365 of all United States and PCT international applications listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in such prior applications in the manner provided by the first paragraph of 35 U.S.C. 112, I acknowledge the duty to disclose material information as defined in 37 C.F.R. 1.56 which occurred between the filing date of the prior applications and the national or PCT international filing date of this application :

PRIOR U.S. OR PCT APPLICATION(S)

Application Serial No.	Day/Month/Year filed	Status : Patented, Pending, Abandoned
<b>PCT/FR00/02245</b>	<b>04.08.2000</b>	

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true ; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

And I hereby appoint

James R. Longacre Reg. No. 24,421, John M. White Reg. No. 32,634  
Scott J. Anchell Reg. No. 35,035w, Matthew W. Stavish Reg. No. 36,286  
Longacre & White  
6550 Rock Spring Drive - Suite 240  
Bethesda, Maryland 20817

(to whom all communications are to be directed)

to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith and with the resulting patent.

1-00 1) Inventor's Signature Daniel Richard  
Inventor's Name (typed) **Daniel RICHARD**  
First Middle Initial Family Name  
Residence (City) **MAROLLES EN BRIE FRX**  
Post Office Address (Include zip code) **11 rue des Potiers**

Date **02/12/2001**  
Citizenship **FRANCE**  
State/Foreign country  
**94440 MAROLLES EN BRIE - FRANCE**

2) Inventor's Signature  
Inventor's Name (typed)  
First Middle Initial Family Name  
Residence (City)  
Post Office Address (Include zip code)

Date  
Citizenship  
State/Foreign country

3) Inventor's Signature  
Inventor's Name (typed)  
First Middle Initial Family Name  
Residence (City)  
Post Office Address (Include zip code)

Date  
Citizenship  
State/Foreign country

4) Inventor's Signature  
Inventor's Name (typed)  
First Middle Initial Family Name  
Residence (City)  
Post Office Address (Include zip code)

Date  
Citizenship  
State/Foreign country